NICOLAUS COPERNICUS UNIVERSITY IN TORUŃ

Bulletin of Geography. Socio-economic Series, No. 68 (2025): 29-44
http://doi.org/10.12775/bgss-2025-0012

BULLETIN OF GEOGRAPHY. SOCIO–ECONOMIC SERIES

journal homepages:
https://apcz.umk.pl/BGSS/index
https://www.bulletinofgeography.umk.pl/

The Rest of the World sector's role in the intersectoral flow of funds systems of the Visegrad Group countries

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How to cite:
Przybyliński, M. & Trębska, J. (2025). The Rest of the World sector's role in the intersectoral flow of funds systems of the Visegrad Group countries. *Bulletin of Geography. Socio-economic Series*, 68(68): 29-44. DOI: http://doi.org/10.12775/bgss-2025-0012

Abstract. The study aims to assess the involvement of the Rest of the World (RoW) sector in the economies of Poland, the Czech Republic, Slovakia, and Hungary (the Visegrad Group, V4) as manifested by its short-term impact on disposable income (and other macro categories) through exports, investment grants, and the acquisition of financial assets. We propose a method that provides unambiguous and replicable results based on a standardised accounting system that is congruent across all European countries. The starting point is the sequence of records in the System of National Accounts (SNA). Then we construct an Input–Output Table for Institutional Sectors. Finally, we build a simple input–output model and conduct a deterministic simulation that is equivalent to the hypothetical extraction method. The main conclusion is that exports are the most important channel of foreign influence on the economy.

Article details:
Received: 19 December 2023
Revised: 28 March 2025
Accepted: 15 May 2025

Key words:
Visegrad Group, geography, planning & development, input-output analysis, national accounts

Contents:

1. Introduction

1.1. Background and motivation

Increasingly large and complex, global value chains are becoming the subject of intense study. Recently, the importance of research on these chains has increased due to the COVID-19 pandemic and the outbreak of war in Ukraine. Both of these events led to significant disruptions in the functioning of economies. Studies on international resource–material links also play an important role in estimating the ecological footprint.

Research conducted in these streams most often omits the financial aspect, however, which is of great importance for the development of the real economy. Taking this aspect into account and tracing the links between institutional sectors instead of inter-industry links is a promising research avenue, and it is made possible by the available databases. The Flow of Funds (FoF) method of national accounting tracks the economy and covers both real and financial transactions. A broader description and review of the literature devoted to the applications of the FoF can be found in Section 1.2 "Payer–payee relationships in the SNA".

The aim of this article is to examine selected economies' dependence on foreign countries, distinguished by institutional sectors. A relatively simple simulation model is used for ascertaining how economic relations with foreign countries included in the System of National Accounts (SNA) affect the functioning of individual institutional sectors. Thus, the differences in the degree and nature of dependence on foreign countries between households, government, and non-financial and financial corporations are indicated.

The research is based on a complete sequence of the SNA (the list of transactions is presented in Table A1 in the Annex) in the form of intersectoral flows, the so-called "payer–payee matrix". The results of the estimation of these matrices and their statistical analysis in the context of foreign sector involvement in the V4 group countries have been presented by Przybyliński and Trębska (2023).

This study proposes a model based on the classic input–output approach, modified to show links between institutional sectors and extended to other accounts within the SNA. The method of hypothetical extraction (HEM) is used, i.e., a counterfactual simulation involving the removal (zeroing) of the elements of our model that reflect specific activities of the foreign sector is conducted (see, e.g., Dietzenbacher et al., 2019; for a more comprehensive description of methods for assessing the importance of individual branches and the links between them, see Lach, 2020). The effect of foreign influence on the domestic economy (broken down by institutional sector) is determined by comparing the simulation results with the actual values. An Input–Output Table for Institutional Sectors (IOTIS), a new application of the classic input–output table, is introduced herein. Also, the HEM has not yet been used in research on links between institutional sectors. The idea of IOTIS estimations and results for the V4 group countries in 2020 are presented in section 2.1.

One of the popular methods of assessing the links between institutional sectors within national accounts is the multiplier analysis based on SAM (Social Accounting Matrix). SAM multipliers are an extension of the classic input–output production multipliers considering income links (effects). However, their main weakness is the difficulty in formulating the model so that it would be possible to use the hypothetical extraction method. Separating the Rest of the World (RoW) account as the only exogenous item would lead to zero values if this account were reset. Separating other accounts as exogenous would, in turn, ignore income effects.

This type of simulation could also be based on complex multi-sectoral economic or economic-econometric models, such as CGE (Computable General Equilibrium) or Inforum (Almon, 2011). These models simulate realistic economic development scenarios or introduce specific economic policy tools. However, due to the complexity of these models, the practical replication of results is very difficult.

Thanks to its simplicity, the proposed model has three advantages: interpretative clarity, consistency within the applicable statistical reporting system, and the replicability of the research, which results from the first two advantages. The scheme of our model is described in section 2.2, while the assumptions and results of the simulations, followed by a short discussion, are presented in section 3. Section 4 contains the main conclusions.

1.2. Payer–payee relationships in the SNA

The flow of funds accounts can be presented in various forms. They are usually published as a set of accounts that represents transactions made by units grouped into institutional sectors. Units make and receive payments to and from other units that can be classified in the same or another institutional

sector. Each payment is classified by the sector executing it and by its purpose, i.e., the type of transaction. Each transaction is simultaneously shown as the outflow of funds for one sector (payer) and an inflow for another (payee) (Copeland, 1949). The first official statistics based on this idea was *Flow of Funds in the United States 1939–1953* (Board of Governors …, 1955). Originally, flow of fund (FoF) accounts were conceived as a set of data on financial assets acquired by institutional sectors and liabilities incurred by them. Since 2013, these data have been published as *Financial Accounts of the United States*. This document comprises tables of financial transactions made by institutional sectors, levels tables, and balance sheets for assets and liabilities, as well as integrated macroeconomic accounts (a sequence of non-financial transactions that are mainly consistent with the SNA). Data for European Union countries, compiled according to the European System of Accounts (ESA 2010), are published in the Eurostat database (https://ec.europa.eu/eurostat/web/main/data/database). There are annual and quarterly national accounts, annual and quarterly sector accounts, and supply, use, and input–output tables (the latter published with varying frequency).

More complex FoF accounts consist of three-dimensional matrices. The first two dimensions describe institutional sectors (or units grouped according to different classifications) involved in transactions, and the third presents various forms of transactions. These matrices, known as payer–payee matrices (P-P) or matrices on a "from-whom-to-whom" basis (W-to-W), show who (which sector) pays whom and using which form of transaction. The most commonly known example of recording data in this form is the first quadrant of the symmetrical input–output table. The producers make the transactions on goods and services that meet intermediate consumption of specific goods and services according to the NACE classification (*Nomenclature statistique des Activités économiques dans la Communauté Européenne*). In other words, P-P matrices indicate where the money comes from, where it goes, and what "kind" of money it is (Klein, 2003). This is the essence of FoF analysis. It is comparable with input–output analysis in the sense that Copeland's money-flow method of national accounting is analogous to the commodity-flow method (Kuznets, 1937) and national accounting based on input–output accounts known as the product-flow method (Leontief, 1936).

The complete set of P-P matrices covers transactions in the sequence of non-financial accounts (current and capital) and financial accounts. The need to link the financial and "real" spheres of the economy was highlighted by the financial crisis of 2008. In this context, many note the need to fully integrate the financial balance sheet and accumulation account (see *Financial Stability* …, 2009; Shrestha et al., 2012; Palumbo & Parker, 2009). The importance of this problem increases with the growing degree of global financial integration, which speeds up the spread of financial shocks around the world (Tsujimura & Tsujimura, 2011). In response to criticism that the classical FoF analysis (the asset–liability matrix based on the balance sheet) only accounts for the financial system and thus overestimates the effects on the real sphere of the economy (e.g., production), Tsujimura and Tsujimura (2018) proposed the expanded FoF matrix (a sum of matrices that reveal transactions recorded on both financial and non-financial accounts).

It is rare to publish data on a W-to-W basis. Usually, it is data on financial assets and liabilities, e.g., financial accounts: counterpart information that can be found in the Eurostat database. Empirical analyses based on data in this format (payer–payee matrices) usually employ estimation methods of converting data on national accounts. Such analyses focus on the functioning of financial systems, often in the context of recent financial crises, policy impact assessment, sectoral interlinkages, and international integration. The connections between financial savings and tangible investments are investigated much less often, e.g.:

- Tsujimura and Mizoshita (2003) presented the compilation procedure of the Asset–Liability Matrix (ALM) from the FoF accounts in the balance sheet format; an input–output model based on the ALM was used to examine the Bank of Japan's quantitative easing policy.
- Dawson (2004) analysed the financial crisis in Thailand by quantitatively tracing the significant financial flows between the private and banking sectors based on estimated quarterly FoF accounts.
- Nishiyama (2008) applied a financial macroeconometric model for the United States, based on Klein's FoF model, to estimate the effect of an increase in net worth held by households and non-profit organisations.
- Tsujimura and Tsujimura (2011) simulated the negative consequences of home mortgage delinquencies during the last subprime mortgage crisis in the US from the

perspective of the interrelations between the balance sheets of various economic sectors.
- Okuma (2012) applied input–output analysis to the sectoral interlinkage approach based on balance sheets and simulated ripple effects of financial shocks transmitted between sectors.
- Yoshino and Mizoguchi (2013) analysed intersectoral FoF in Japan during the Bubble Period of the 1980s to 2010. They also investigated the differences between the Greek and Japanese government bond markets.
- Kim (2017) added the chaebol sector (a South Korean form of business conglomerate) to the asset–liability matrix to explain this sector's role in the Korean financial system.
- Pedauga, Velázquez and Bueno (2018) applied a GRAS algorithm to estimate a complete series of W-to-W matrices of Property Income for the Spanish economy between 1999 and 2016.
- Tsujimura and Tsujimura (2018) introduced a new method of tracking FoF that covers both real and financial transactions to show the mechanism and the effects of US quantitative easing; in 2021, they analysed intersectoral flows in the US economy between 2001 and 2018.
- Burkowski and Kim (2018) investigated the structure of the financial system in the Brazilian economy using an asset–liability matrix for the years 2004 to 2014. They analysed the role of each institutional sector in the Brazilian financial system and the origin of recessions in the Brazilian economy; their 2019 study was also devoted to the last topic.
- Trębska (2018) examined the role of households' financial savings in the network of intersectoral linkages based on the financial input–output model.
- Zhang and Zhao (2019) and Zhang and Zhu (2021) used data on the W-to-W format to measure global FoF, i.e., international flows of direct investments, portfolio investments, and other financial investments.
- Hagino and Kim (2021) compiled from-whom-to-whom financial stock tables for Japan, Korea, the United States and China and analysed the development of the international flow of funds accounts.

Rearranging the accounts in the transactions-sectors form into intersectoral flows (W-to-W) is analogous to transforming the supply and use tables into the balance of inter-industry flows of goods and services (Miller & Blair, 2009).

2. Research materials and methods

2.1. The input–output table aggregated for institutional sectors

The classic input–output table consists of three quarters, of which, the first shows intermediate consumption, the second – final demand, and the third – value added. The table used in the simulation has the same features, although fundamental differences exist. A symmetric table in a product-by-product layout shows the distribution of intermediate and final products of each group (written in the rows of the table) as well as the value added created in the production of these products (written in columns). In the input–output table aggregated for institutional sectors (IOTIS) that is proposed in this paper and used as the core of the model described in the next section, the rows and columns correspond to the institutional sectors. Thus, the first quarter (**X**) shows the expenditure of domestic sector j on purchases of intermediate products produced by domestic sector k, including government revenues from taxes on production. They are flows between domestic institutional sectors presented in the intersectoral FoF table for the first transaction in the sequence – intermediate consumption ($\mathbf{Z}_1$ for $k,j = 1, \ldots, 4$), excluding taxes less subsidies on products meeting intermediate demand, which are presented in a separate row (as in symmetric input–output table at basic prices).

The second quarter (**Y**) consists of two columns which are the sums of each row ($k = 1, \ldots ,4$) in the FoF tables for final consumption and capital formation ($\mathbf{Z}_2$) and exports ($\mathbf{Z}_3$), excluding taxes less subsidies on products meeting final demand.

The sums of rows – receipts concerning transactions of products:

$$\mathbf{X} \cdot \mathbf{i} + \mathbf{Y} \cdot \mathbf{i} = \mathbf{x} \qquad (1)$$

are the output at basic prices of each domestic institutional sector (**i** is the summing vector).

The third quarter (**W**) consists of three rows. The first comprises data on taxes less subsidies on intermediate products. The second row contains data on imports of intermediate products, which

Table 1. The scheme of IOTIS

	Sector *j*	**Final demand**	**Total output**
Sector *k*	**X** Flows of intermediate products from domestic sector *j* to *k*	**Y** Final consumption, capital formation, exports (resources of domestic sector *k*)	**x** Sum of resources of domestic sector *k*
	W Uses of domestic sector *j* – taxes less subsidies on intermediate products, imports of intermediate products and value added		
Total output at basic prices	$\mathbf{x}^T$ Sum of uses of domestic sector *j*		

Source: own elaboration

is the last row of the FoF table for intermediate consumption – resources of the RoW sector from this transaction ($\mathbf{Z}_1$ for k=5). The third row contains data on value added, which is the sum of compensation of employees ($\mathbf{i}^T\mathbf{Z}_5$), other taxes on production less other subsidies on production ($\mathbf{i}^T\mathbf{Z}_6$), and operating surplus (balancing item of the generation of income account).

The sums of columns ($\mathbf{i}^T\mathbf{X} + \mathbf{i}^T\mathbf{Y} = \mathbf{x}^T$) are, like the sums of the rows, the output of institutional sectors at basic prices, which makes the table balanced.

Based on IOTIS, meaningful economic indicators can be calculated, like equivalents of input–output coefficients. We use this table as the core of the simulation model presented below. The tables for the countries belonging to the V4 group can be found in Annex.

2.2. The model

In our model, IOTIS is recursively connected with an identity-centred model based on the sequence of national accounts reflected by a set of intersectoral FoF tables.

Satisfying equation 1 by IOTIS allows the use of the classical Leontief model (see Miller & Blair 2009: 15–21):

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} = \mathbf{L} \cdot \mathbf{y}, \quad (2)$$

where A=X · $\hat{\mathrm{x}}^{-1}$ and y=Y · i, L is a matrix of input–output multipliers, which show the changes in x resulting from the increase in y by a unit.

Based on the final demand, we determine the primary income:

$$\mathbf{p} = \mathbf{P} \cdot \mathbf{x}, \quad (3)$$

where P = $\hat{\mathrm{p}} \cdot \hat{\mathrm{x}}^{-1}$, is a matrix of parameters calculated using empirical data on primary incomes in relation to output. This proportion includes property income flows ($\mathbf{Z}_7$).

The sequence of FoF tables Zi for secondary distribution of income transactions (i°=°8, °…11) determines disposable income:

$$\mathbf{d} = \mathbf{p} + \mathbf{b}, \quad (4)$$

where $\mathbf{b}$=[($\mathbf{Z}_8$ + ... + $\mathbf{Z}_{11}$)-($\mathbf{Z}_8$+ ... +$\mathbf{Z}_{11}$)^T] $\mathbf{i}$ are net current transfers. Each of $\mathbf{Z}_i$ matrix can be determined depending on the assumptions made in the model. In the simplest version, all these transfers could be proportional to $\mathbf{x}$.

Saving is determined residually as the difference between disposable income and final consumption c, previously set in vector y. Additionally, saving is adjusted for the change in pension entitlements ($\mathbf{Z}_{12}$ in the system of FoF tables):

$$\mathbf{s} = \mathbf{d} - \mathbf{c} + (\mathbf{Z}_{12} - \mathbf{Z}_{12}^T) \cdot \mathbf{i}. \quad (5)$$

The balancing item for the sequence of non-financial accounts in the SNA – net lending (if positive) or net borrowing (if negative) – is determined residually:

$$\mathbf{l} = \mathbf{s} + \mathbf{t} - \mathbf{f}, \quad (6)$$

where: **f** is exogenous capital formation, $\mathbf{t}=[(\mathbf{Z}_{13}+\mathbf{Z}_{14}+\mathbf{Z}_{15})-(\mathbf{Z}_{13}+\mathbf{Z}_{14}+\mathbf{Z}_{15})^{T}]\mathbf{i}$ is net capital transfers which are capital taxes, investments grants and other capital transfers. These flows tables are determined depending on the assumptions made in the model.

In this model, it was assumed that changes in the income of domestic entities do not influence their final expenditure. This assumption was applied in every simulation in the study. Hence, this is designed to answer how the debt of individual domestic sectors would change if foreign demand were reduced (which would entail a decrease in the income of domestic entities). Domestic entities would like to maintain the current level of consumption and accumulation.

3. Simulation results

The FoF model was applied for three separate simulations. In an attempt to measure the short-term impact of RoW on the economies of Visegrad group countries, the following questions are posed:

1. How would disposable income change if the final demand decreased by the total volume of exports of goods and services?
2. How would disposable income change if the final demand decreased by fixed capital formation financed by investment grants provided by RoW?
3. How would disposable income change if the final demand decreased by purchases of domestic sectors financed by financial assets acquired by the RoW?

When discussing the simulation results, reference is also made to the payer–payee matrices estimated for 2000–2020.

3.1. What if there were no exports?

In simulation 1, the following assumptions concerning equations 2–6 are set:

- in equation 2, the final demand vector is lowered by the value of exports;
- in equation 3, the changes in primary incomes are proportional to changes in output;
- in formula 4, net current transfers are proportional to output, except for social benefits paid by the general government, which are constant due to the principles of the social security system;
- in equation 5, final consumption expenditure is constant; changes in adjustment for the change in pension entitlements are proportional to the changes in primary income;
- in formula 6, net capital transfers are proportional to output.

Exports of goods and services constitute about 40% of final demand (in 2020: 37.6% in Poland, 43.2% in the Czech Republic, 44.7% in Hungary, and 46.3% in Slovakia). This share increased significantly after joining the EU – by five percentage points in Hungary (2020 compared to 2000), eight p.p. in the Czech Republic and Slovakia, and ten p.p. in Poland. In the Czech Republic, Slovakia, and Hungary, the revenues of the non-financial corporations sector, i.e., the leading producer of goods and services manufactured for export, constitute about 90% of total exports. This share is lower than 80% in Poland since the share of the household sector is more significant than in the other V4 countries. Thus, there is a more substantial share of micro-enterprises in the economy.

As expected, the declines in primary incomes caused by the extraction of exports are proportional to the role exports play in the economies of those countries. Primary income decreases most in Slovakia, by 62%, and slightly less in Hungary, by

Table 2. Changes in primary (1) and disposable income (2) caused by the extraction of exports (Visegrad group 2020)

Sector	Poland		Czech Republic		Slovakia		Hungary	
	1	2	1	2	1	2	1	2
Non-financial corporations	-55.2%	-55.2%	-62.4%	-62.4%	-70.1%	-70.1%	-69.1%	-69.1%
Financial corporations	-30.2%	-30.2%	-46.7%	-46.7%	-50.2%	-50.2%	-47.2%	-47.2%
General government	-14.1%	-28.3%	-17.0%	-28.6%	-19.3%	-34.0%	-18.6%	-27.7%
Households & NPISH	-40.9%	-29.8%	-42.8%	-32.0%	-48.7%	-37.5%	-47.5%	-38.4%
Total economy	-40.1%	-33.8%	-54.8%	-36.4%	-62.0%	-41.2%	-59.6%	-40.4%

Source: own calculations

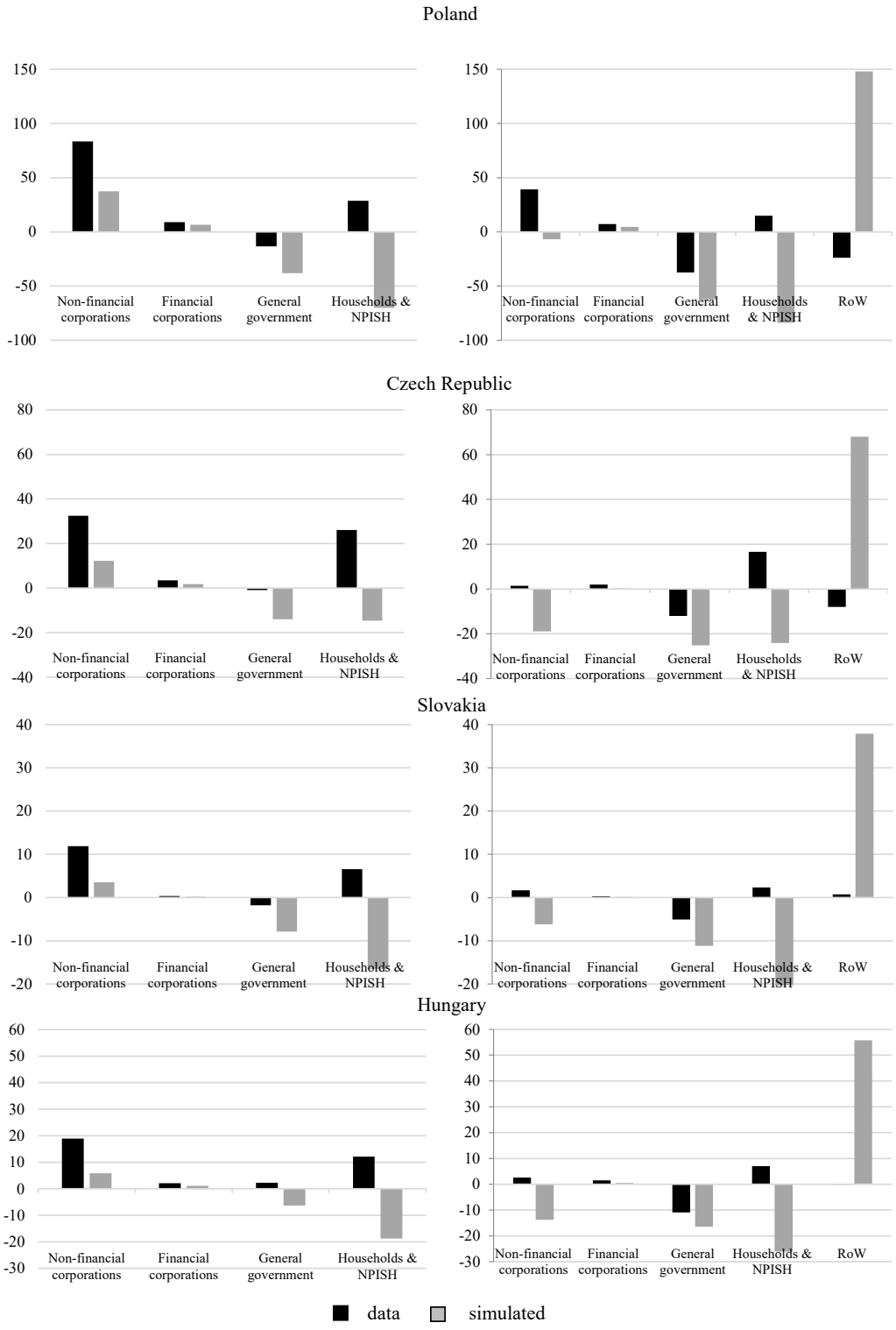

Fig. 1. Changes in the balancing items of the current and capital account (Visegrad group 2020) caused by the cessation of exports (€ billions)

almost 60%. Lower declines are observed in the Czech Republic (54.8%) and Poland (47.5%). Since the non-financial corporations sector is the most heavily involved in product transactions, this sector's primary income changes are the largest (both in absolute and percentage terms). For non-financial and financial corporations, the percentage changes in primary and disposable incomes are the same, since all current transfers in which these sectors participate are proportional to their output. The assumption of constant payments of social benefits means that the changes in income redistribution involve a particularly significant reduction in the disposable income of the general government sector, which simultaneously mitigates the decline in primary income of the household sector.

Savings can be positive when current resources exceed expenditures, or negative otherwise. In 2020, current expenditures exceeded the current resources of the general government in Poland, the Czech Republic, and Slovakia, which were recorded as negative savings streams in the SNA. Only in Hungary did all domestic institutional sectors generate positive savings streams. A simulated decrease in disposable income with the assumption of constant consumption causes a significant reduction in the savings of general government, households & NPISH (consumer sectors). Changes in the savings of non-financial corporations are proportional to changes in the disposable income of this sector, as is the case with financial corporations (with the accuracy of adjustments for the change in pension entitlements).

Net lending recorded in the sequence of accounts for a given sector means that its current and capital revenues exceed the sum of all expenditures (including capital expenditures), while net borrowing is the opposite. In other terms, net lending/net borrowing is the difference between saving and accumulation, down to the net capital transfers. Hence, the assumption of constant capital formation leads to a decrease in this balancing item that is even greater than the decrease in saving (see Fig. 1).

In the simulation assumptions, imports of final goods remain unchanged, which causes a negative current account balance, since the exports are extracted. Moreover, a decrease in the savings of domestic sectors, with unchanged capital formation, leads to the emergence or deepening of the net borrowing of domestic institutional sectors from the RoW. The budget deficit as a percentage of GDP increases by 6.6 p.p. in Slovakia, 6.4 p.p. in Hungary, 6.1 p.p. in the Czech Republic, and 4.7 p.p. in Poland.

3.2. What if there were no investment grants from RoW?

The second simulation assumes that RoW does not grant domestic investments. Therefore, the table of this form of capital transfers is changed, i.e., all the transfers from the last column of table $\mathbf{Z}_{14}$ are extracted, decreasing capital formation and resources in terms of product transactions.

Thus, the following assumptions concerning equations 2–6 are set:

- in equation 2, the final demand vector is lowered by the decrease in capital formation (a decrease in resources of sectors that produce investment products for final use);
- in equation 3, changes in primary incomes are proportional to changes in output;
- in equation 4, net current transfers are proportional to output, except for social benefits paid by general government;
- in equation 5, final consumption expenditure is constant; changes in adjustment for the change in pension entitlements are proportional to the changes in primary income;
- in equation 6, net capital transfers are proportional to output, except for investment grants from RoW; capital formation (vector **f**) is decreased by the value of investment grants from RoW.

The scope of financing accumulation from investment grants from RoW significantly increased after the Visegrad group joined the European Union. In 2000, subsidies in this form accounted for less than 0.5% of accumulation, while in 2010, it was 6–10%. In 2020, it slightly decreased, except in Poland, where it increased from 7.5% in 2010 to 10.1% in 2020.

In 2020, investment grants from RoW as a source of financing capital formation accounted for only 1.2% of final demand in Poland and Hungary, 0.7% in the Czech Republic, and 0.3% in Slovakia. Such low shares mean that the effects of extracting these transactions are relatively small compared to the first simulation results. As expected, the decline in primary incomes caused by the extraction of investment grants from RoW is biggest in Poland and smallest in Slovakia, proportional to the role of this form of financing capital formation in these economies (see Table 3). These grants are transfers, the largest part of which goes to the general government, so the lack of these subsidies would lower the income and savings of this sector the

Table 3. Changes in primary (1) and disposable income (2) caused by the cessation of RoW investment grants (Visegrad group, 2020)

Sector	Poland		Czech Republic		Slovakia		Hungary	
	1	2	1	2	1	2	1	2
Non-financial corporations	-0.9%	-0.9%	-0.5%	-0.5%	-0.2%	-0.2%	-0.7%	-0.7%
Financial corporations	-1.2%	-1.2%	-0.9%	-0.9%	-0.4%	-0.4%	-1.3%	-1.3%
General government	-1.7%	-3.5%	-1.1%	-1.8%	-0.7%	-1.2%	-1.8%	-2.7%
Households & NPISH	-1.2%	-0.9%	-0.7%	-0.6%	-0.3%	-0.3%	-1.1%	-0.9%
Total economy	-1.1%	-1.3%	-0.6%	-0.8%	-0.3%	-0.4%	-0.9%	-1.3%

Source: own calculations

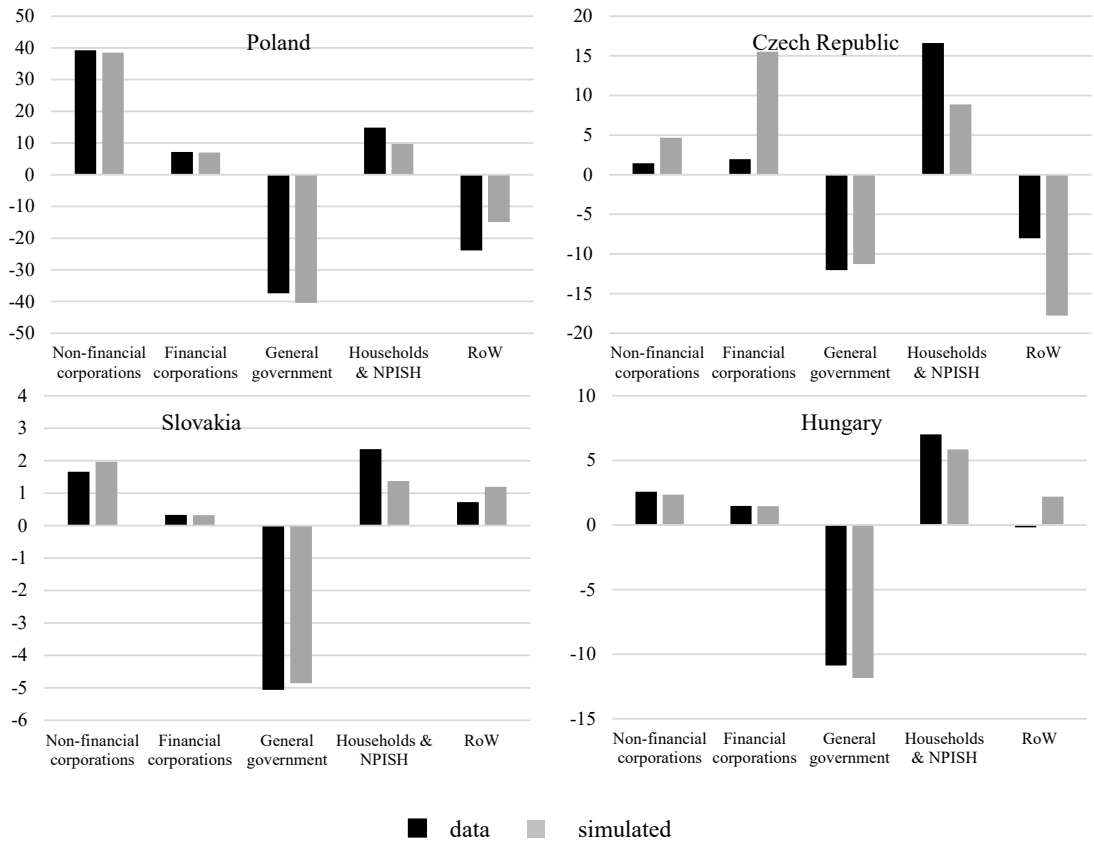

Fig. 2. Changes in net lending/net borrowing (Visegrad group 2020) caused by the cessation of RoW investment grants (€ billions)
Source: own elaboration

most. Of course, the incomes of all other domestic institutional sectors are also diminishing.

Corporations' savings decrease in proportion to changes in disposable income. The assumption of constant consumption means that the savings of the general government and households & NPISH decline even more than disposable income. In contrast, the assumption that a decrease in capital formation equals a reduction in investment grants from RoW causes a decline in net lending/net borrowing equal to a decrease in savings (in absolute terms). For the government, an increase in budget deficit equals a reduction in savings.

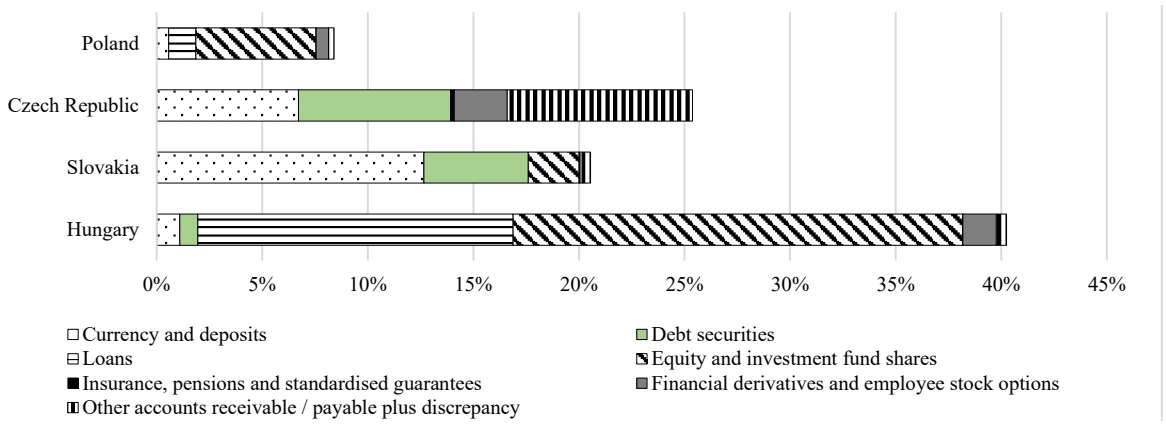

Fig. 3. Structure of assets purchased by the Rest of the World sector in 2020
Source: own elaboration based on Eurostat database, https://ec.europa.eu/eurostat/databrowser/view/nasa_10_f_tr/default/table?lang=en

3.3. What if there were no financial assets acquired by RoW?

The third simulation experiment assumes that domestic sectors finance a certain part of their final expenditure with revenues from the issue of financial assets acquired by the RoW sector. In the absence of RoW acquiring financial assets, domestic sectors reduce their demand for both intermediate and final products. However, the structure of assets purchased by the RoW sector determines the scale of the decline in income of individual institutional sectors as issuers of these assets. The presentation of the simulation assumptions requires a short statistical introduction.

The scale of the influence of RoW on the economies of the Visegrad group countries through the financial system is diverse. In 2020, over 40% of total financial asset transactions in Hungary were assets purchased by RoW, while in Poland, it was much lower than 10% (see Fig. 3). The structure of assets is also characterised by high diversity. In Hungary, the acquisition of equity and investment fund shares was dominant in RoW financial investments; this group of financial instruments was also popular in Poland. However, what attract this sector's attention in the Czech Republic are debt securities, currency, deposits, and other accounts receivable/payable plus discrepancies. The RoW sector's financial investments in Slovakia in 2020 focused on currency, deposits and debt securities.

The data for other years also show a significant variation in these structures over time. For example, in 2010, in Poland, almost 60% of the financial assets acquired by RoW (13.1% of the total sum of transactions of financial instruments) were debt securities. In contrast, in 2020 and 2019, this sector mainly disposed of these instruments. In Hungary, the share of loans in 2010 was equal to 0 because, in that year, the value of loans repaid by domestic sectors, previously granted by RoW, was higher than that of newly incurred loans.

The sectoral structure of resources resulting from financial investments of RoW (see Fig. 4) is derived from the FoF tables estimated for the flows of each financial instrument ($\mathbf{Z}_{16}$, …, $\mathbf{Z}_{23}$). As a consequence of RoW not acquiring financial assets, the expenditures of these asset issuers decrease, e.g., consumption and investments of the general government sector (a major issuer of debt securities) and investments of corporations (the leading issuers of equities). The changes introduced in the exogenous vector of the simulation model reflect the decline in revenues of institutional sectors due to the decrease in final demand.

The following assumptions were made in the model:

- in equation 2, the final demand is reduced because of the lack of assets purchased by RoW; the size of this decrease is proportional to the ratio between consumption and capital formation of individual institutional sectors and also results from their revenues from the financial assets purchased by RoW; it should be noted, however, that some part of these revenues is used to acquired financial assets that are not part of final demand; ultimately, changes in consumption and capital formation lead to a decrease in resources of sectors that produce products for final use;

- in equation 3, changes in primary incomes are proportional to changes in output;
- in equation 4, net current and capital transfers are proportional to output, except for social benefits paid by the general government;
- in equations 5 and 6, in conjunction with 9, final consumption expenditures (vector **c**) and capital formation (vector **f**) are reduced due to RoW no longer acquiring financial assets (e.g., debt securities issued by a government, loans granted to households); a decrease in resources in this form affects the consumption, capital formation and acquisition of financial assets depending on the structure of these uses of a given sector; reduction in adjustment for the change in pension entitlements is proportional to the changes in primary income.

As expected, the effects of the RoW stopping financial investments are most extensive in Hungary (decreases of 4.6% in total primary income and 6.4% in disposable income) and smallest in Poland (declines of about 1% for the total economy) (see Table 4). Such massive differentiation results from RoW involvement in financial transactions in these countries. In turn, the structure of the RoW sector's connections concerning the financial instruments of domestic sectors is reflected in changes in their income. In each country, the income of the general government declines the most. This is due to the relatively large amount of debt to RoW and because the funds obtained from abroad are spent by this sector more on consumption and capital formation (exogenous variables in the model) than on financial investments. The reverse is observed for financial corporations. The scope of this sector's financial links with RoW is much greater (especially in Hungary). Still, the effect on the real economy is much less significant, as this sector uses funds from abroad mainly for financial investments. Unfortunately, the structure of the simulation model does not allow for the analysis of the feedback between the financial investments of the financial corporations sector and production and income generation.

On the other hand, the financial assets acquired by RoW are the liabilities of domestic institutional sectors. Therefore, a reduction in liabilities results in a decrease in the net lending of RoW (an increase in the net lending of the national economy) or an increase in its net borrowing (see Fig. 4). The net lending of the non-financial corporations sector is growing the most, which is mainly due to the reduction in acquisitions of the equities issued by this sector. The changes in the financial corporations sector are insignificant, as the decrease in its incurrence of liabilities corresponds to a similar reduction in the acquisition of financial assets.

4. Conclusions

The extent of the RoW sector's impact on the economies of the V4 countries was assessed using counterfactual simulations based on a hypothetical extraction method. Comparing the results of the three simulations leads to the conclusion that exports are the most crucial channel of foreign influence on the economy. The devastating effects of extracting exports while trying to maintain the current level of consumption and investment would involve significant changes in the reduction of savings. As a result, domestic institutional sectors are indebted to foreign countries, including doubling the budget deficit. In the case of the household sector, net lending would turn into a very significant net debt. The reaction to the decline in exports is similar across all countries.

Simulation experiments were conducted for 2020, which was unusual given that economies

Table 4. Changes in primary (1) and disposable income (2) caused by RoW ceasing to acquire financial assets (V4 group 2020)

Sector	Poland		Czech Republic		Slovakia		Hungary	
	1	2	1	2	1	2	1	2
Non-financial corporations	-0.9%	-0.9%	-2.4%	-2.4%	-1.3%	-1.3%	-3.6%	-3.6%
Financial corporations	-1.1%	-1.1%	-3.9%	-3.9%	-2.4%	-2.4%	-6.8%	-6.8%
General government	-1.1%	-2.2%	-4.4%	-7.4%	-3.4%	-6.0%	-8.5%	-12.7%
Households & NPISH	-1.1%	-0.8%	-3.3%	-2.4%	-2.0%	-1.5%	-5.7%	-4.6%
Total economy	-1.0%	-1.1%	-2.8%	-3.6%	-1.6%	-2.4%	-4.6%	-6.4%

Source: own calculations

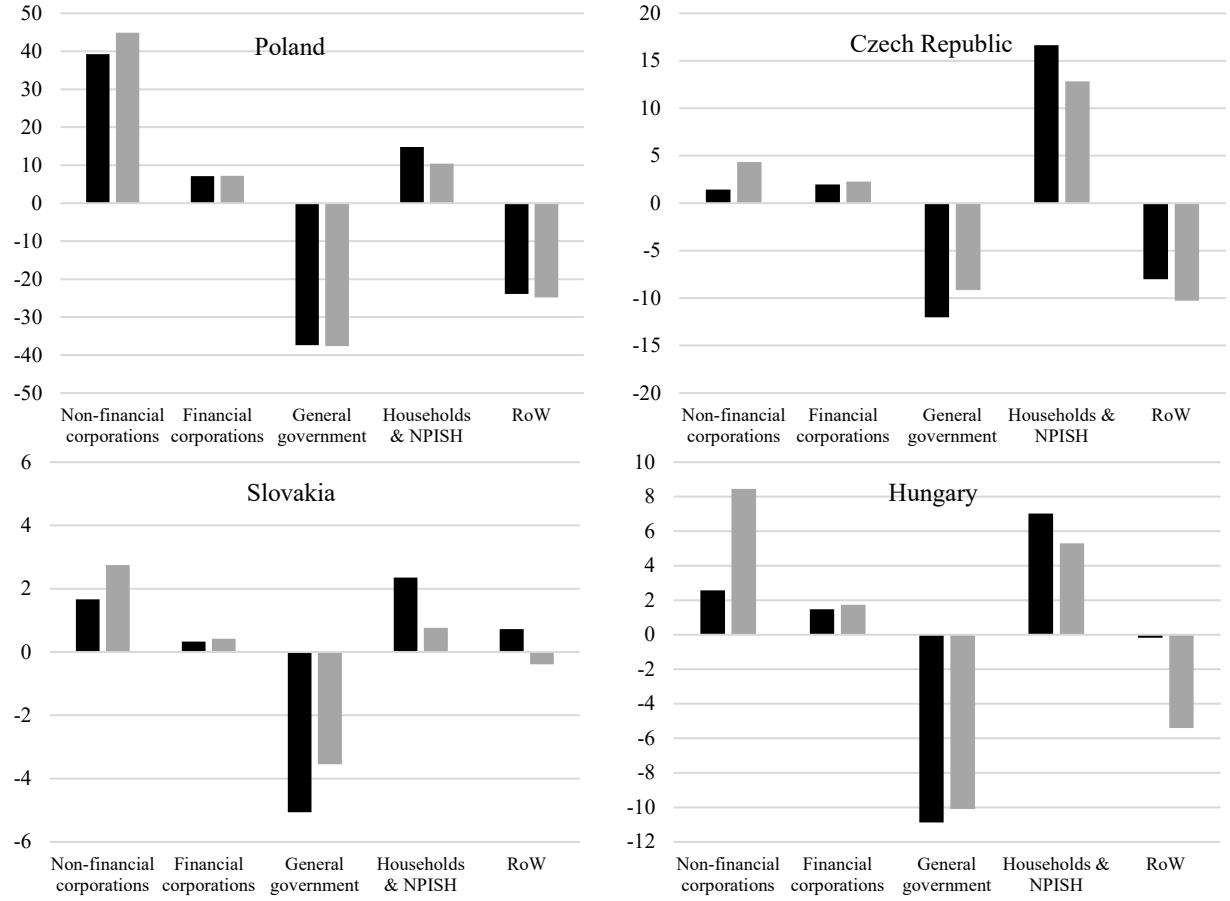

Fig. 4. Changes in net lending/net borrowing (Visegrad group 2020) caused by RoW ceasing to acquire financial assets by (€ billions)
Source: own elaboration

worldwide were functioning under the extraordinary conditions of the COVID-19 pandemic. However, the central cross-sectoral relationships that affect the simulation results did not change significantly in 2020 compared to 2019. The share of exports in final demand changed by less than one percentage point (decreasing in the Czech Republic, Slovakia, and Hungary and increasing only in Poland). Additionally, the level of investment grants from the RoW sector remained relatively constant. Coupled with a decrease in accumulation, it means an increase in their importance in financing tangible investments. On the other hand, the RoW sector increased its involvement in financial investments only in the Czech Republic; in the other V4 countries, this sector's share of net acquisitions of financial assets in total transactions in financial instruments decreased. Therefore, it is difficult to indicate the effects of the pandemic on foreign involvement in the V4 economies.

Finally, the study made it possible to formulate conclusions regarding the simulation methodology and its potential development. Based on the input–output approach, the simulation method provides unambiguous and replicable results based on a standardised accounting system. It is compatible in all European countries, enabling international comparisons. However, the simulation results depend on the model structure and the assumptions. The model assumes a constant level of consumption and accumulation, but an alternative might be a model assuming a continual propensity to save. Then, a decrease in disposable income would have to be reflected in a decline in final demand. Taking into account such an assumption would require the addition of an income–demand loop to the model. Then, after determining the disposable income from equation (4), new values of the y vector should be determined, and then the simulation procedure

returns to equation (2). Still, other hypothetical assumptions can be imagined.

This type of research has not been conducted so far, so it is not possible to compare the presented results with others. The influence of the RoW on the economies of various countries has been studied primarily in the scope of material flows, most often on a macro scale or in product or industry disaggregation. Interactions between institutional sectors are rarely analysed. In particular, for the V4 countries, they have not been conducted at all so far.

The feedback in the model is limited to the FoF table for transactions that reflect production. The following stages of the model's development should include further elements of the sequence of national accounts in the demand–income feedback loop. Additionally, the model's analytical properties and the simulation analysis's informational value could be improved by basing its core part on the table for product transactions disaggregated simultaneously by institutional sector and CPA (Classification of Products by Activity). Regardless of the complexity of the model used, it shows the differences in the impact of RoW on the economies of the V4 countries. The reasons for the variability, like the impact of government fiscal policy or central bank monetary policy, can be the subject of a more in-depth analysis.

The advantages of the above proposed method mentioned in the introduction have been confirmed. The recent political upheavals, both local and global – especially the war in Ukraine, which has the most substantial impact on neighbouring countries, including the V4 – show that this kind of research is essential in the context of analysing the effects of imposing various types of economic sanctions or restrictions on the free flow of products and capital between economies.

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Appendix

Table 1A. The list of transactions distinguished in the flow of funds tables $\mathbf{Z}_i$

Group of transactions	Transaction	*i*
Transactions of products	Intermediate consumption	1
	Final consumption and capital formation	2
	Exports of goods and services	3
	Imports of goods and services	4
Transactions of generations and allocation of primary income	Compensation of employees	5
	Other taxes on production less other subsidies on production	6
	Property income	7
Transactions of secondary distribution of income and capital transfers	Current taxes on income	8
	Net social contributions	9
	Social benefits other than social transfers in cash	10
	Other current transfers	11
	Adjustment for the change in pension entitlements	12
	Capital taxes	13
	Investment grants	14
	Other capital transfers	15
Transactions of financial instruments	Special drawing rights	16
	Currency and deposits	17
	Debt securities	18
	Loans	19
	Equity and investment fund shares	20
	Insurance, pensions, and standardised guarantees	21
	Financial derivatives and employee stock options	22
	Other accounts receivable/payable plus discrepancy	23

Source: own elaboration based on the sequence of accounts in the SNA

Table 2A. IOTIS for Poland in 2020 (in € billions)

		Intermediate consumption (uses)				Final demand		Output
		1	2	3	4	5	6	7
Intermediate consumption (resources)	1	214.9	6.6	14.6	41.7	173.6	244.6	696.0
	2	12.3	0.4	0.8	2.4	14.6	1.7	32.2
	3	14.9	0.5	1.0	2.9	77.5	4.6	101.3
	4	68.2	2.1	4.6	13.2	82.7	43.2	214.1
Taxes less subsidies on intermediate products	8	13.1	0.4	0.9	2.5			
Value added	9	245.3	18.3	70.7	126.7			
Imports of intermediate products	10	127.4	3.9	8.6	24.7			
Output	7	696.0	32.2	101.3	214.1			

1 – Non-financial corporations, 2 – Financial corporations, 3 – General government, 4 – Households & NPISH, 5 – Final consumption and capital formation, 6 – Exports
Source: own elaboration based on Eurostat database

Table 3A. IOTIS for the Czech Republic in 2020 (in € billions)

		Intermediate consumption (uses)				Final demand		Output
		1	2	3	4	5	6	7
Intermediate consumption (resources)	1	106.2	2.9	6.2	12.4	75.1	13.7	341.6
	2	8.1	0.2	0.5	1.0	3.4	0.8	14.1
	3	7.3	0.2	0.4	0.9	34.5	2.8	46.1
	4	23.5	0.7	1.4	2.8	23.8	10.0	62.2
Taxes less subsidies on intermediate products	8	4.2	0.1	0.3	0.8			
Value added	9	120.0	7.9	33.0	35.6			
Imports of intermediate products	10	72.4	2.1	4.3	8.8			
Output	7	341.6	14.1	46.1	62.2			

1 – Non-financial corporations, 2 – Financial corporations, 3 – General government, 4 – Households & NPISH, 5 – Final consumption and capital formation, 6 – Exports
Source: own elaboration based on Eurostat database

Table 4A. IOTIS for Slovakia in 2020 (in € billions)

		Intermediate consumption (uses)				Final demand		Output
		1	2	3	4	5	6	7
Intermediate consumption (resources)	1	45.8	1.0	2.4	1.8	28.1	71.9	151.0
	2	2.7	0.1	0.1	0.1	1.3	0.4	4.7
	3	3.6	0.1	0.2	0.1	14.0	1.0	19.1
	4	9.9	0.2	0.5	0.4	9.7	5.4	26.1
Taxes less subsidies on intermediate products	8	-0.1	0.0	0.0	0.6			
Value added	9	45.7	2.4	13.5	20.8			
Imports of intermediate products	10	43.5	1.0	2.3	2.2			
Output	7	151.0	4.7	19.1	26.1			

1 – Non-financial corporations, 2 – Financial corporations, 3 – General government, 4 – Households & NPISH, 5 – Final consumption and capital formation, 6 – Exports
Source: own elaboration based on Eurostat database

Table 5A. IOTIS for Hungary in 2020 (in € billions)

		Intermediate consumption (uses)				Final demand		Output
		1	2	3	4	5	6	7
Intermediate consumption (resources)	1	46.8	1.1	4.4	3.2	39.1	98.6	193.2
	2	4.2	0.1	0.4	0.3	2.1	0.4	7.5
	3	4.7	0.1	0.5	0.3	24.1	2.4	32.1
	4	10.3	0.2	1.0	0.7	12.9	8.0	33.2
Taxes less subsidies on intermediate products	8	3.9	0.1	0.3	0.7			
Value added	9	68.2	4.4	20.2	23.5			
Imports of intermediate products	10	55.2	1.4	5.3	4.3			
Output	7	193.2	7.5	32.1	33.2			

1 – Non-financial corporations, 2 – Financial corporations, 3 – General government, 4 – Households & NPISH, 5 – Final consumption and capital formation, 6 – Exports
Source: own elaboration based on Eurostat database